PCB Technical Challenges

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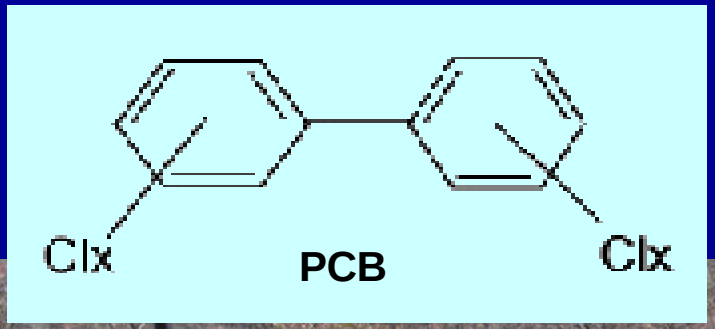
Discussion Overview

- PCB Background
- Legacy vs. Current Sources
- PCB Analysis
- TMDL Development
  - Data needs
- PCB WQC vs. Site Specific Endpoints

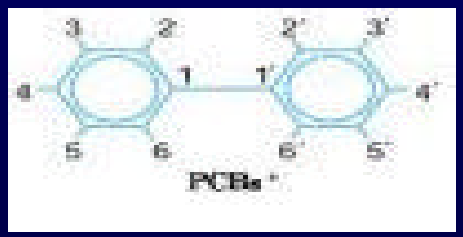


PCBs - Background

- Estimated that > 1.5 Billion lbs. manufactured in the U.S. until 1977
- Very stable and heat resistant
- Common uses:
  - Transformers, capacitors, hydraulic fluids, circuit breakers, PVC Products, carbonless copy paper, caulking material, etc.

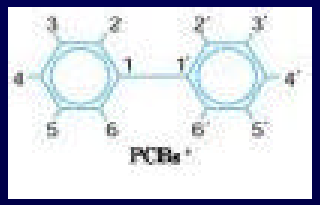
What are PCBs?

- Biphenyl molecule (1-10 chlorine atoms)
- 209 distinct PCB Compounds – “Congeners”
- Total PCB (tPCB) = Summation of 209 Congeners *(Basis for VA WQC)*
- Aroclors – mixture of congeners
  - Aroclor 1248 is 48% chlorine



PCB Characteristics

- Lower chlorination – more susceptible to decay and volatilization to atmosphere
- Higher chlorination – more persistent
- Hydrophobic – attach to organic particles in soil and sediment
- Lipophilic – accumulate in the fatty tissues
- Probable carcinogen
- Disruption of hormone function in aquatic life



PCBs - A Legacy Pollutant?

- Banned in late 70's
- Accumulate and persist in river sediments from historic releases
  - "Hot Spots"
- Generally not detected under VPDES Program

PCBs – Current Releases?

- PCBs used many years after banned
- Contaminated sites with active transport
- Dielectric oils considered non PCB < 50 ppm
  - Fish advisories at 0.05 ppm
- Inadvertent production

Examples of Current PCB Sources

- Direct and Indirect Sources
  - Storm water runoff
    - Contaminated sites
    - Leaking transformers
  - Industrial/Municipal Point Sources
  - Atmospheric Deposition
    - Contaminated sites (PCB off-gas)
    - Combustion of contaminated recycled oil
  - Sediment “Hot Spots”

Transformer in Creek

PCBs - A Legacy Issue?

- Yes & No
  - PCBs have been banned but upland releases continue
  - Model results from tidal TMDLs suggest PCBs may persist for 40-50 years before fish tissue attainment reached
    - Unknown if applies to free flowing rivers

Analytical Needs

- TMDL Problem
  - Lacking ambient water and effluent PCB data at concentrations relevant to the WQC
  - Data deficiency require assumptions regarding loadings; or
- Solution
  - Utilize a method that can measure low level PCBs

Promulgated Analytical PCB Methods

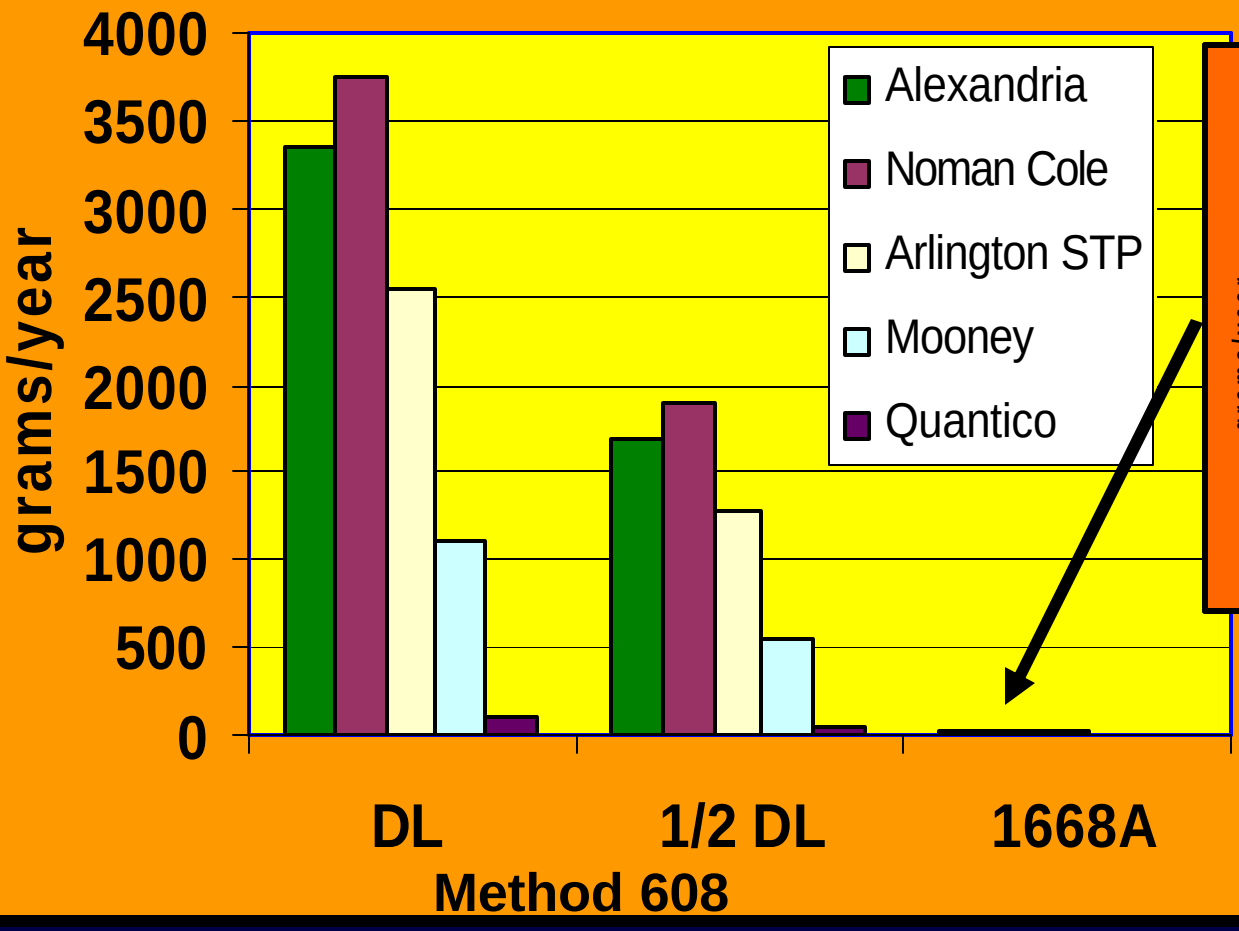
- EPA Analytical Methods for PCBs (40 CFR Part 136)
- Method 608 and Method 625 – target Aroclors
  - Method 608
    - Permit reporting level 500,000 – 1,000,000 pg/L
    - Detection level = 65,000 pg/L
  - Method 625
    - Reporting level 50,000,000 pg/L
- Total PCB WQC = 1,700 pg/L

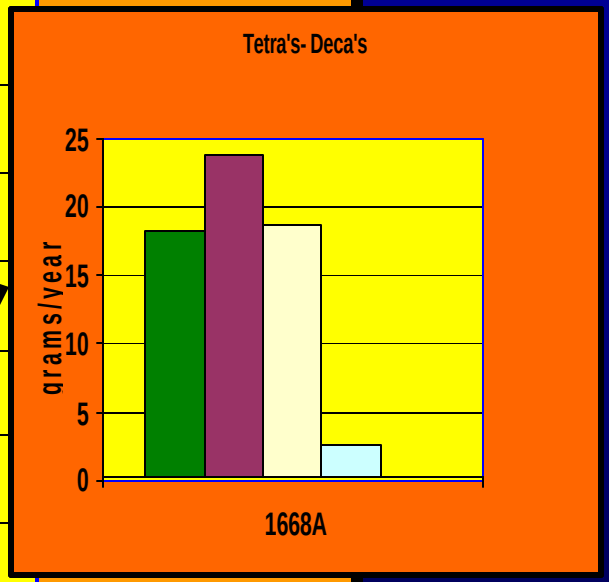
EPA Method 1668A

- Non-Promulgated performance based method
  - High Resolution GC/High Resolution MS
- Measures Tot. PCB - Congener-specific basis
  - Detection Level 5 pg/L (or 0.000005 ug/L)
  - Reporting Level 8-12 pg/L
- Used by DRBC for Delaware River TMDL
- Used for the Potomac River TMDL
- Currently being used for the Roanoke (Staunton) River and Levisa Fork TMDLs

WWTP Loadings
(Assumptions with Method 608 and Actual Data Using Method 1668A)

PCB Conc. x Monthly Ave. Flow = Loading





PCB TMDL Data Requirements

- Ambient Water (Lacking data)
  - Promulgated methods incapable of detecting low levels
  - Collect samples during low and high flow
- Point Source Effluent (includes MS4)
  - Enable calculation of a more realistic loading
- Sediment (project dependent)
- Atmospheric PCB Data
  - Studies in urban areas have shown the atmosphere to be contributing a PCB load (esp. for large water bodies)
  - Data have not been collected in Virginia
- Contaminated Sites (File search)

Water Quality Criterion vs. Site Specific Endpoint

VA Criteria

Consumption Advisories Fish Tissue (ppb)	Water Quality Criterion Total PCBs (ppb) (February 2004)
50	0.0017

–WQC represents concentration in water column where accumulation of PCBs in fish should be at a level protective of fish tissue for consumption (humans)

PCB Exposure Pathways to Fish

- Intake through gills from water column
- Ingestion of prey
  - Biomagnification
- Ingestion of contaminated sediment
  - Indirect uptake from foraging
- Exposure through skin from contaminated sediment (e.g. catfish)

PCB Water Quality Criterion

- Existing WQC (1,700 pg/L)
- Proposed WQC (640 pg/L)
  - September 2008
  - Change based on increased fish consumption from 6.5 g/day to 17.5 g/day
- Both values derived from PCB water concentration (EPA 1980 Guidelines)
- Inclusion of other exposure pathways (e.g. feeding) preferred but statewide data do not exist (EPA 2003 Guidelines)

Site Specific PCB Endpoint

- TMDL Studies show that criterion met instream but fish remain contaminated
- Site Specific Endpoint
  - Accounts for localized conditions which can affect bioaccumulation
    - Utilizes site specific water and fish data
    - Accounts for trophic transfer
  - Potomac R. water endpoint (64 pg/L)
  - Proposed Roanoke R. endpoint (98 pg/L)
- Applies to TMDL development